

INVACO
INDUSTRIAL VALVE COMPANY



Trunnion Mounted Ball Valve

Trunnion Mounted Ball Valve

Model 4000:

API 6D, API 607 / API 6FA

Size - 2" to 60" (50mm to 1500mm)

Rating - Class 150 to Class 2500

Full Bore Design

Reduced Bore Design

Two Piece Design

Three Piece Design

Forged Steel Valves

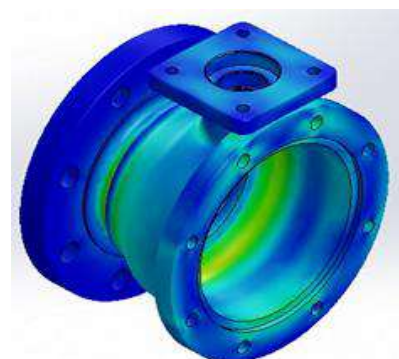
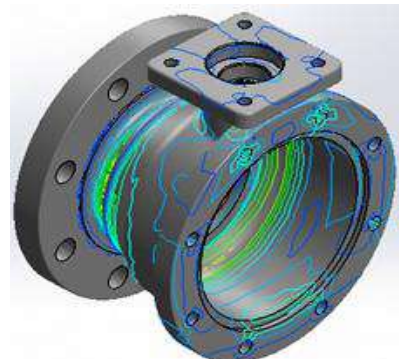
Cast Steel Valves

www.invacovalves.com

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TMBV – Trunnion Mounted Ball Valve



Company Overview

“INVACO” (Industrial Valve Company) founded and promoted by the technocrats having experience of 18 years in National and International valve industry. INVACO PRIVATE LIMITED (Industrial Valve Company) is registered experience company in Design, Development, Fabrication & Manufacturing of Industrial Valves. Our mission is to produce high quality and reliable Valves to our national & international clients / customers. Our proactive approach to technical issues enables to understand and implement cost-effective solutions to our valuable customers.

“INVACO” (Industrial Valve Company) committed to excellence by manufacturing top quality valves to exceed customer’s needs with low cost, on-time delivery & providing finest service in industry. “INVACO” manufacture Ball valves (Floating & Trunnion Mounted), Butterfly Valves (Damper, Sleeved, Double offset & Triple Offset), Gate Valves, Globe Valves , Check Valves, Strainers, Flap Valves, Dismantling Joints, Flange Adaptor, Flange Couplings, Sluice Gate / Penstock for Oil & Gas, Petrochemicals, Refineries, Power Plants, Water Treatment Plants, Chemical, Paper & Pulp, Sugar, Steel, Pharma, Pipeline Transmission and other process industries.

“INVACO” (Industrial Valve Company) is specialized in design, manufacturing & testing of FORGED & CAST Steel Trunnion Mounted Ball Valves. All valves are designed as per API 6D, ASME B16.34 and fire safe as per API 607 / API 6FA, MESC SP 77 – 100, 130 follows ISO 9001:2015 Quality Management Systems. INVACO, manufacture trunnion mounted ball valve size from 2” to 60” (50mm to 1500mm) with pressure range from Class 150 to Class 2500 and equivalent DIN / EN pressure ratings. Ball valves produced from

FORGED & CAST materials like A105N, LF2, F6A, F304L, F316L, F22, F51, F52, F53, F55, WCB, WCC, WC6, LCB, LCC, CA15, CF8, CF8M, CF3, CF3M, 4A,5A, 6A, Aluminum Bronze, Incoloy (825 , 925) , Inconel (625, 718 & 750) , Monel (K400, K500), Alloy 20, Hast Alloy and other special materials.

INVACO aims to produced a zero defect valves for long life and reliable services. Making continual improvements aims towards to minimize the Total Ownership Cost for valued customers.

This catalog provides basic information of Trunnion Mounted Ball valves. Every effort has been made to maintain technical accuracies; however INVACO has reserve rights to make any change in design and materials without prior notice.



Quality Policy

At “INVACO”, we established this comprehensive Quality Management System to implement a strategy of continual improvement and compliance with the requirements of the ISO 9001:2008 Quality Assurance standard and other industrial valves standards by:

Customer Focused:

- Make commitments, we fully understand and believe we can meet and deliver.
- Meet all commitments to customers on time.
- Satisfy our customer’s needs and exceed their expectations.

Performance Driven:

- Verify that our products and services meet customer requirements.
- Monitor benchmark and continuously improve our business, products, and services, organization and employee’s performance.

Entire “INVACO” stick to the spirit and intent of this policy to ensure customer satisfaction is achieved at all respects and times.



Quality Standards for Ball Valve

American Petroleum Institute (API)

API 6D	API 6A
API 598	API Spec Q1
API 607	API 6FA

American Society of Mechanical Engineers (ASME)

ASME B16.34	ASME B16.5
ASME B16.47	ASME B16.10
ASME B16.25	

British / European Standards

BS 5351	BS 6755
BS 4504	BS EN 558
BS EN 1092	BS EN 12266
EN 10204	BS EN 6364

International Organization for Standardization (ISO)

ISO 9001:2015	ISO 5208
ISO 5211	ISO 14313
ISO 17292	ISO 15848

Manufacturers Standardization Society (MSS - SP)

MSS SP-6	MSS SP-25
MSS SP 44	MSS SP 45
MSS SP 55	MSS SP 61
MSS SP 72	MSS SP 82

National Association of Corrosion Engineers (NACE)

NACE MR 01-75	NACE TM 01-77
NACE TM 02-84	NACE MR 01-03

Materials and Equipment Standards and Code (MESC)

MESC SPE 77/100	MESC SPE 77/130	MESC SPE 77/110	MESC SPE 77/211
MESC SPE 77/300	MESC SPE 77/302	MESC SPE 77/312	MESC SPE 77/200

Inspections & Testing of Ball Valve

Test	Applicable Standards	Extent of Test
Visual Inspection	MSS SP - 55	100%
Marking Inspection	MSS SP - 25	100%
Chemical, Physical & Heat Treatment	Relevant ASTM Standards	100%
Alloy Verification / Positive Material Identification(PMI)	INVACO Procedure	Upon Customer Request
Hardness Requirement	NACE MR 01 - 75	Upon Customer Request
Radiographic Testing (RT) (X-Ray & Gamma Ray)	ASME B16.34 (Annex B) , ASTM E94 , E142 , E446 , E186 , E280, BPVC Sec V-Art 7 & 22, ASME Sec VIII - Div-1	Upon Customer Request
Ultrasonic Testing (UT)	ASME B16.34 , ASTM A388 , A609 , A578 , BPVC Sec V - Art 4 & 23, ASME VIII Div-1	Upon Customer Request
Magnetic Particle Inspection(MPI)- (Dry & Wet)	ASME B16.34 Annex C , ASTM E709 , ASTM A275 , E1444, ASME Sec VIII Div-2, BPVC Sec V - Art 7 & 23	Upon Customer Request
Liquid / Dye Penetrant Inspection (LP / DP)	ASME B16.34 Annex D ,ASTM E 165 , E1417 , ASME Sec VIII Div 1,BPVC Sec V - Art 6 & 24.	Upon Customer Request
Impact Test	ASTM A 370	Upon Customer Request
Microstructural & Ferrite Content measurement	ASTM E 562	Upon Customer Request



Microscopic / inclusion Count Test	ASTM E 45	Upon Customer Request
Pitting Corrosion	ASTM G 48	Upon Customer Request
Crevice Corrosion	ASTM G 48	Upon Customer Request
Hydrogen Induced Cracking Test (HIC)	NACE TM 02 - 84	Upon Customer Request
Ferric Chloride Corrosion Test	ASTM A 923	Upon Customer Request
Hardness Test	ASTM E 18 , ASTM E 92, NACE MR 01 - 75	Upon Customer Request
Intergranular Corrosion Cracking (IGC)	ASTM A 262	Upon Customer Request
Chloride Stress Corrosion Cracking Test (CSCC)	NACE TM 01 - 75	Upon Customer Request
Size / Dimension Check	INVACO Approved Drawings	100%
Functional Check	INVACO Approved Drawings	100%
Shell Test (Hydro Test)	API 598, API6D, Approved GA Drawings	100%
Seat Test (Hydro Test)	API 598, API6D, Approved GA Drawings	100%
Backseat Test (Hydro Test)	API 598, API6D, Approved GA Drawings	100%
Seat Test (Air/Pneumatic Test)	API 598, API6D, Approved GA Drawings	100%
Helium Leak / Fugitive Emission Test	ISO 15848, MESC 77 / 312	Upon Customer Request
Torque Test	API 6D , INVACO Procedure	10% or Upon Customer Request
Blasting Report	INVACO Procedure	10% or Upon Customer Request
Surface Finish Report	INVACO Procedure	10% or Upon Customer Request
Painting / Dry Film Thickness Report	INVACO Procedure	10% or Upon Customer Request
Tag No, Serial No, Name Plate	INVACO Procedure	100%
Note: - 1) Backseat test is applicable to Gate & Globe Valve. 2) Above Test available upon customer request with extra cost. 3) For more information kindly contact "INVACO".		

Manufacturing Range for Trunnion Mounted Ball Valve

Design	ASME CLASS / Size - in (mm)					
	150	300	600	900	1500	2500
2 - Piece	2" - 16" (50 - 400)	2" - 16" (50 - 400)	2" - 10" (50 - 250)	2" - 8" (50 - 200)	2" - 6" (50 - 150)	2" - 4" (50 - 150)
3 - Piece	2" - 60" (50 - 1500)	2" - 60" (50 - 1500)	2" - 60" (50 - 1500)	2" - 48" (50 - 1200)	2" - 24" (50 - 600)	2" - 12" (50 - 350)
Flange RF, RTJ & Butt- Weld End	2" - 60" (50 - 1500)	2" - 60" (50 - 1500)	2" - 60" (50 - 1500)	2" - 48" (50 - 1200)	2" - 24" (50 - 600)	2" - 12" (50 - 350)

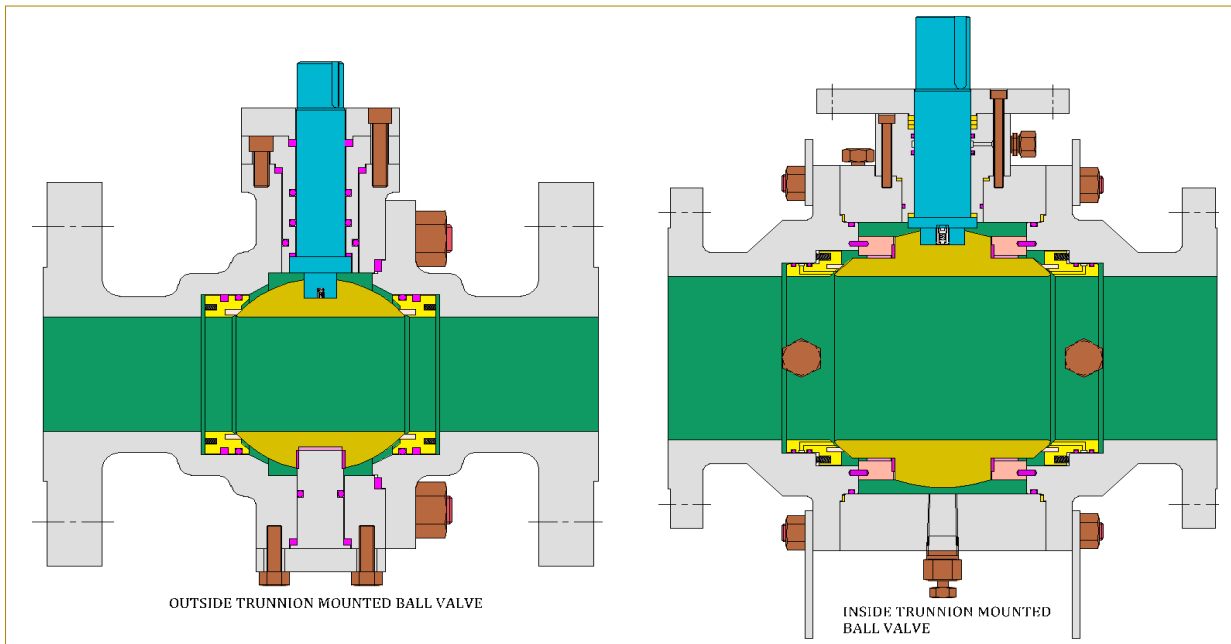


Trunnion Mounted Ball Valve (Model - 4000)

General Description

The ball is mounted between trunnion and stem, free to rotate along the valve centre line while seal or seat ring are floating. There are two type of design available in trunnion mounted ball valves i.e. outside trunnion & inside trunnion plate design. Depend on size or as per customer requirement, INVACO will offer or suggest the design for trunnion mounted ball valve. INVACO recommend outside Trunnion mounted design ball valve for size 4" (100mm) and below. Trunnion is assembled with thrust bearing which absorbed side load of ball under working pressure. Spring loaded design ensures tight sealing by pushing the seat or seal rings against the ball to provide additional load for tight shut off.

INVACO trunnion mounted ball valves are available in 2 piece and 3 piece, Full Bore, Reduced Bore, Flange FF, RF, RTJ and Butt-weld design with wide range of Forging and Casting materials.



Design Features for Trunnion Mounted Ball Valve

**Independent Ball & Stem:-

At INVACO, we always used a solid ball and one piece stem in every ball valve assembly. Under working condition, pressure developed on the ball to create the side thrust, independent ball and one piece stem reduced effect of a side thrust.

**Low Emission, Environment Friendly Valves:-

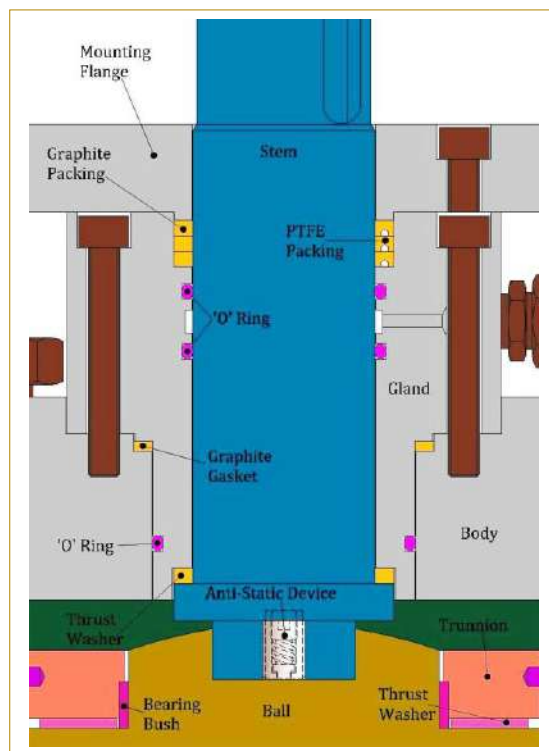
Precise machining process, mirror finish or micro finishing of ball and seat contact surface and proper material selection results in Low Emission Valve. INVACO, trunnion mounted ball valves are designed to meet most severe pollution control regulations. Stem, gland, adapter & body sealing surfaces are designed with double sealing i.e. primary 'O' Ring and secondary graphite packing / gasket sealing. Special "Live Loaded" seals are available on request.

**Explosive Decompression:-

In high pressure service application, there are chances of gas being immersed into the molecular structure of elastomeric O-Ring. If the valve is subjected to decompression, O-ring may destroyed with rapid expansion of gas. AED O-Ring or lip seal used as remedy to overcome the above problem.

**Anti-Static Device:-

Assembly of spring and ball installed between ball and stem which ensure valve parts are grounding. Antistatic device maintain the electrical continuity between all valve components. In other words, antistatic device used to prevent static electricity which may catch fire or light the working fluid.



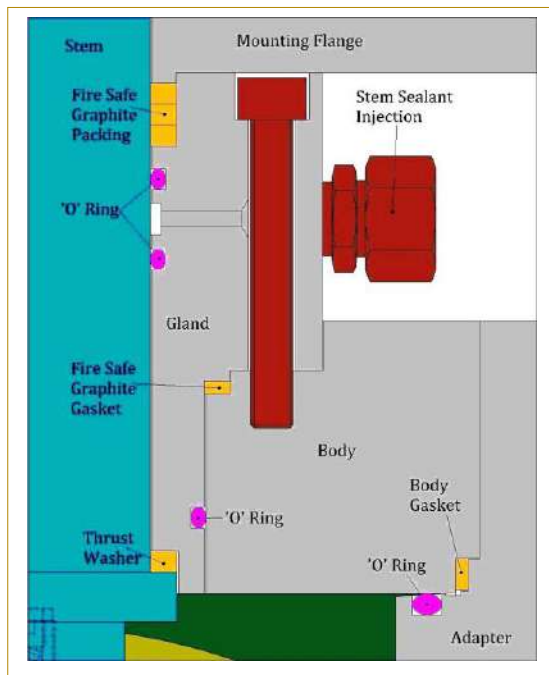
**Blow Out- Proof Stem:-

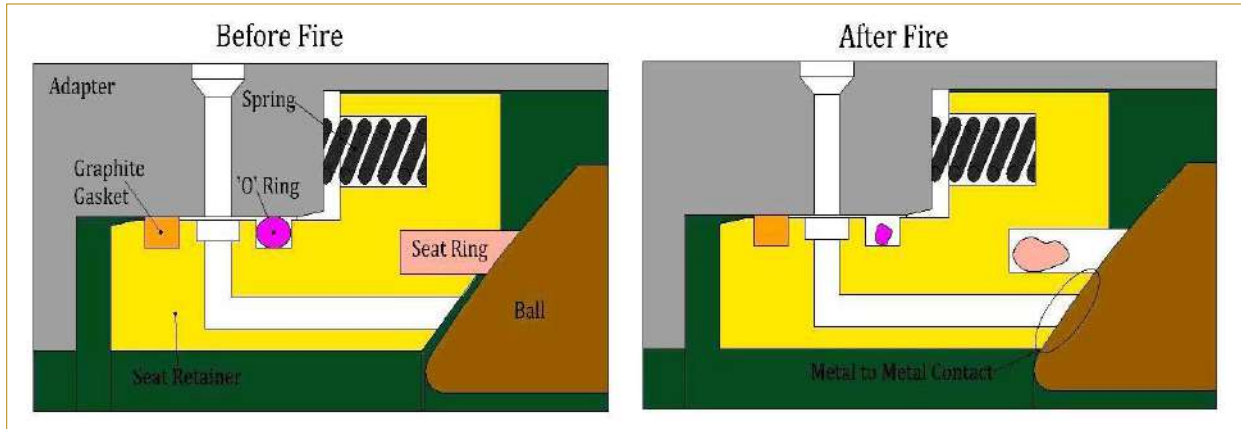
One piece stem designed with integral "T-type" shoulder to provide blow-out proof effectively. The stem internally inserted as function of backseat to withstand working pressure.

**Fire Safe Design:-

Fire safe design is a combination of primary soft seat and secondary metal seat. Soft seat get damage or destroyed with increase in temperature, the upstream pressure push the ball into downstream to make contact between ball and the metal seat which cut off the working fluid and minimized the internal leakage. All INVACO, ball valves are designed for Fire Safe in accordance with API 607 & API 6FA.

Graphite gasket or packing are used between seat retainer and side connection / adapter to prevent internal leakage when soft items like O-ring get damage with increase in temperature.





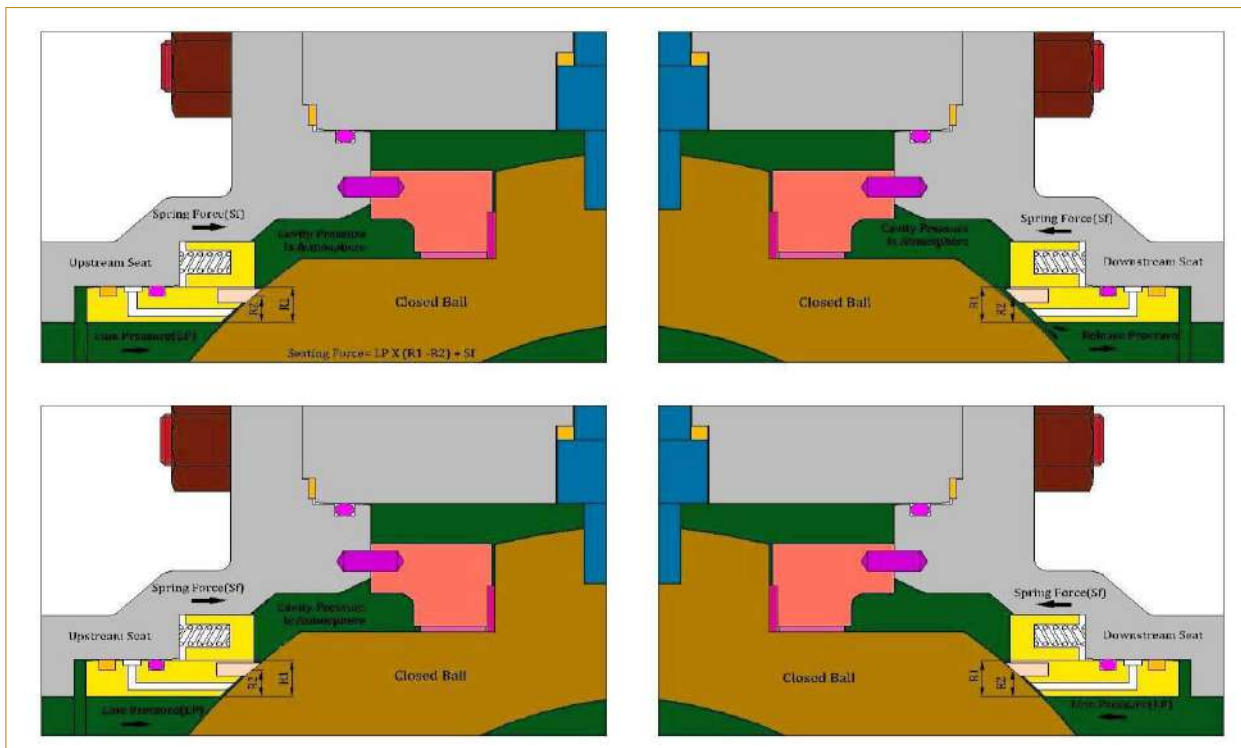
Again with increase in temperature O-rings get damage, secondary graphite gasket / packing between body & side connection or adapter, body & gland flange, and top flange & flange & top flange prevent all possible external leakages from the valve to ensure fire safe design.

****Piston Effect Seal:-**

In standard design, seat rings at inlet side & outlet side are designed and installed to give bi-directional tight shut-off valve. Both upstream & downstream pressure produced resultant thrust which pushes seat rings against ball to attained tight shut-off. Also thrust produced in body cavity pushed seat rings away from the ball.

In fully opened & fully closed position, any over pressure produced in body cavity will automatically release called Single Piston Effect.

When the upstream seat filed, downstream seat will keep valve fully sealed. The over pressure developed in body



cavity can be released through relief valve present on the valve body know as Double Piston Effect.

****Double Block & Bleed:-**

When the ball is in fully opened or in fully closed position, working media or working pressure trapped in body cavity. A double block and bleed features help to release pressure or media trapped in body cavity through drain and vent also verify seat leaking.

****Sealant Injection:-**

As per API 6D requirements each valve have sealant injection equipped in stem and seat ring area. In case of wrong operation, fire or other accidents, soft materials like seat rings, O-rings failed, through injection fittings sealant can be injected to stem and seat areas.

****Drain & Vent:-**

Drain & Vent plug on body installed as per API 6D requirements.

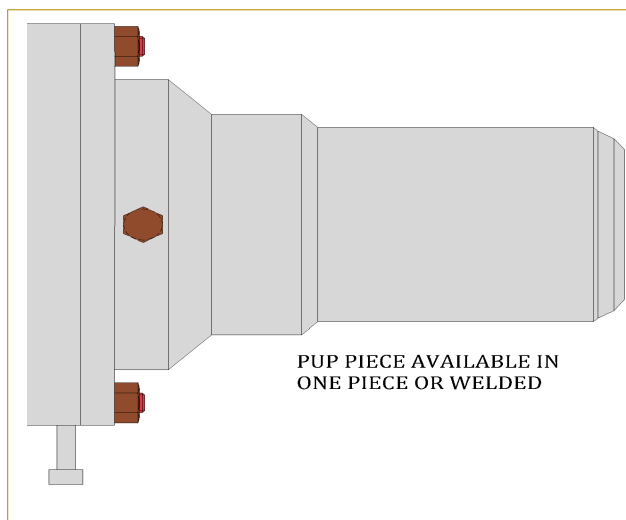
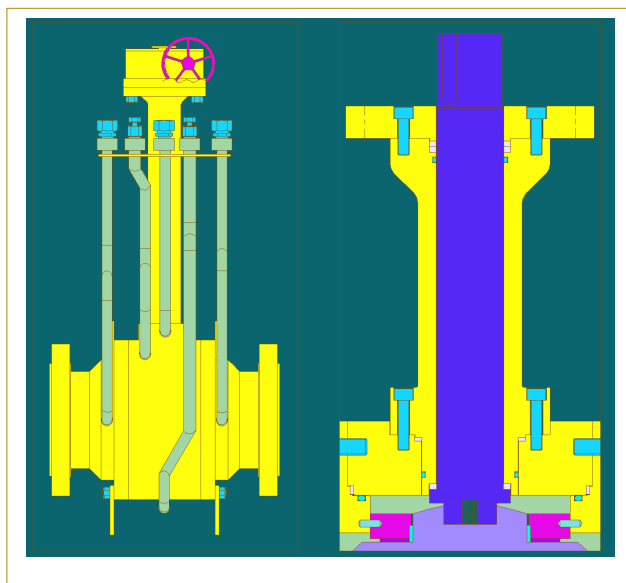
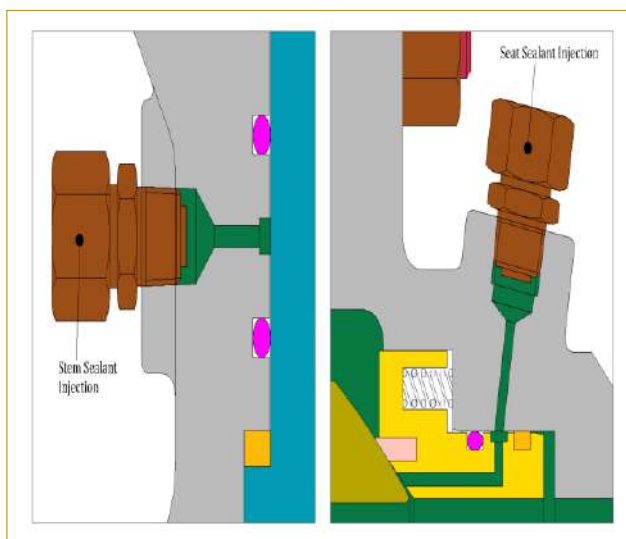
****Extended Bonnet & Stem:-**

Options of extended bonnet designed are available for extreme temperature requirements. Extended bonnets are recommended for cryogenic service (below -50 °C temperature) and high temperature service (above 220 °C temperature). INVACO offers standard bonnet, extended bonnet & extended finned bonnet according to BS 6364, Shell GSI MESC and MSS SP-134.

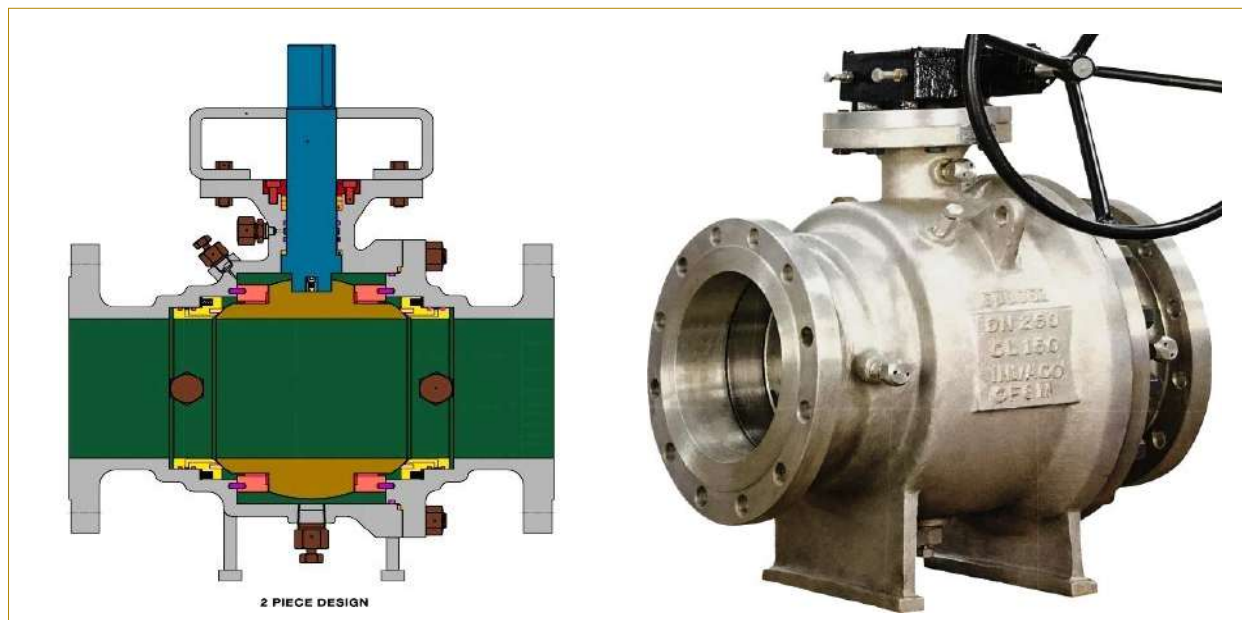
For underground service requirements or in limited access areas, extended stem valves are used. Drain, vent & sealant will also extend through pipe to operate from top.

****Pup Ends:-**

But weld end valves are equipped with transitions pup ends to reduced risk of damage of seal and seat rings during welding and post weld heat treatments.



Trunnion Mounted Ball Valve (Model - 4000)



Quality Standards:-

Design Standards	- API 6D / ASME B16.34 / MESC SPE 77-100,110,130,211,300,302,312.
Testing Standards	- API 598 / API 6D / EN 12266 / ISO 5208 / BS 6755
End to End Standards	- API 6D / ASME B 16.10 / EN 558
Flange Drilling Standards	- ASME B16.5 / ASME B 16.47 / BS EN 1092.
Butt-Weld	- ASME B 16.25
Actuator Mounting	- ISO 5211
Fire Testing	- API 607 / API 6FA / ISO 10497
Fugitive Emission Test	- MESC SPE 77 - 312 / ISO 15848
Cryogenic Services	- BS 6364, MSS SP 134
Valve Marking	- MSS SP 25 / ASME B 16.34
Visual Inspection	- MSS SP 55
Material Testing	- NDE / NACE MR 01- 75 / NACE MR 01- 03 Compliance available.

Key Features:-

- Size :- 2" to 60" (50mm to 1500mm)
- 2Pc / 3Pc Design, Full Bore / Reduced Bore
- Soft , Metal & Fire Safe Design
- Anti - Static Design
- Drain, Vent & Sealant Design
- Pup Piece Available
- Rating:- 150# to 2500# & Equiv. DIN Rating
- Casting / Forging Body with Solid Ball.
- Blow Out Proof Stem
- Piston Effect Design(Spring Loaded)
- Extended Bonnet & Extended Stem
- Manual, Electrical/Pneumatic/Hydraulic Actuator

Materials - Carbon Steel, Low Temperature Carbon Steel, Stainless Steel, Duplex, Super Duplex, Incoloy, Inconel, Monel, Aluminum Bronze, Hastalloy, Titanium and other materials.

Applications -Offshore / Onshore Oil & Gas, Chemical, Petrochemical & Allied Process, Power Plant, Water Treatment Plant, Liquefied Natural Gas, Sugar, Paper & Pulp, Steel, Piping & Process Industries.

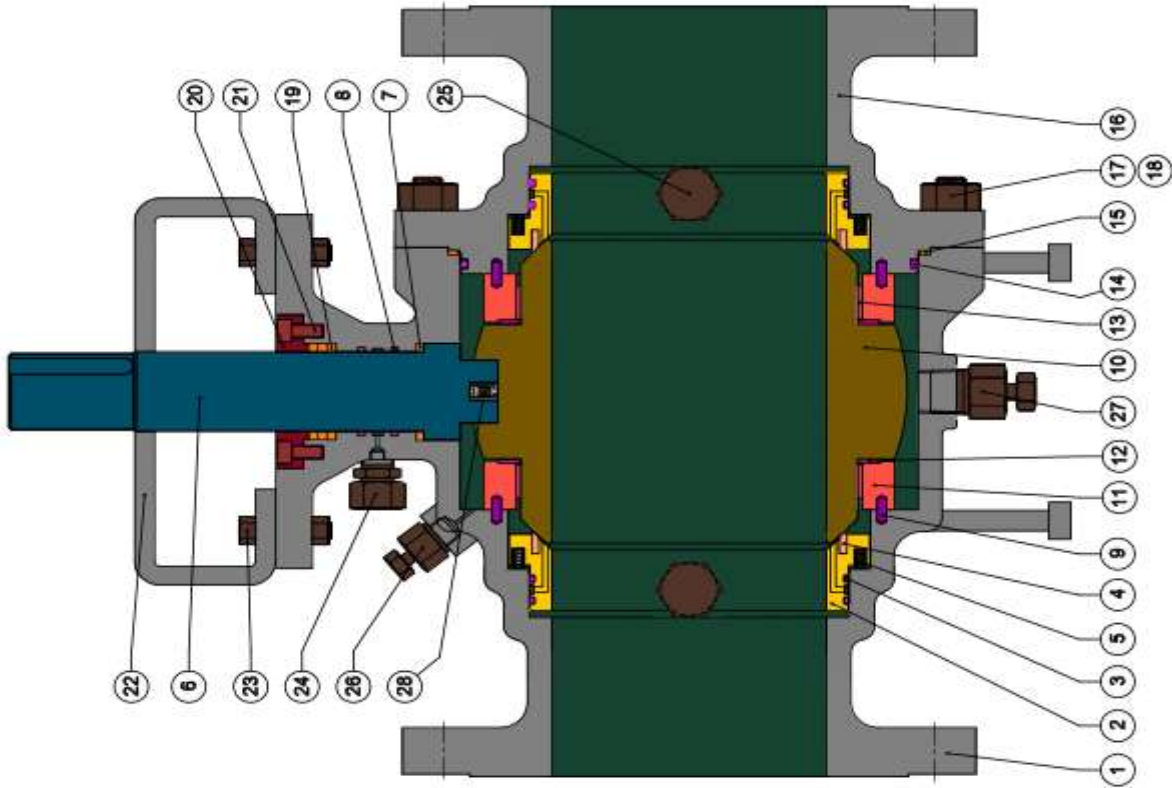
GA Drawing for Trunnion Mounted Ball Valve (Model - 4000)

2 PIECE TRUNNION MOUNTED CASTING BALL VALVE

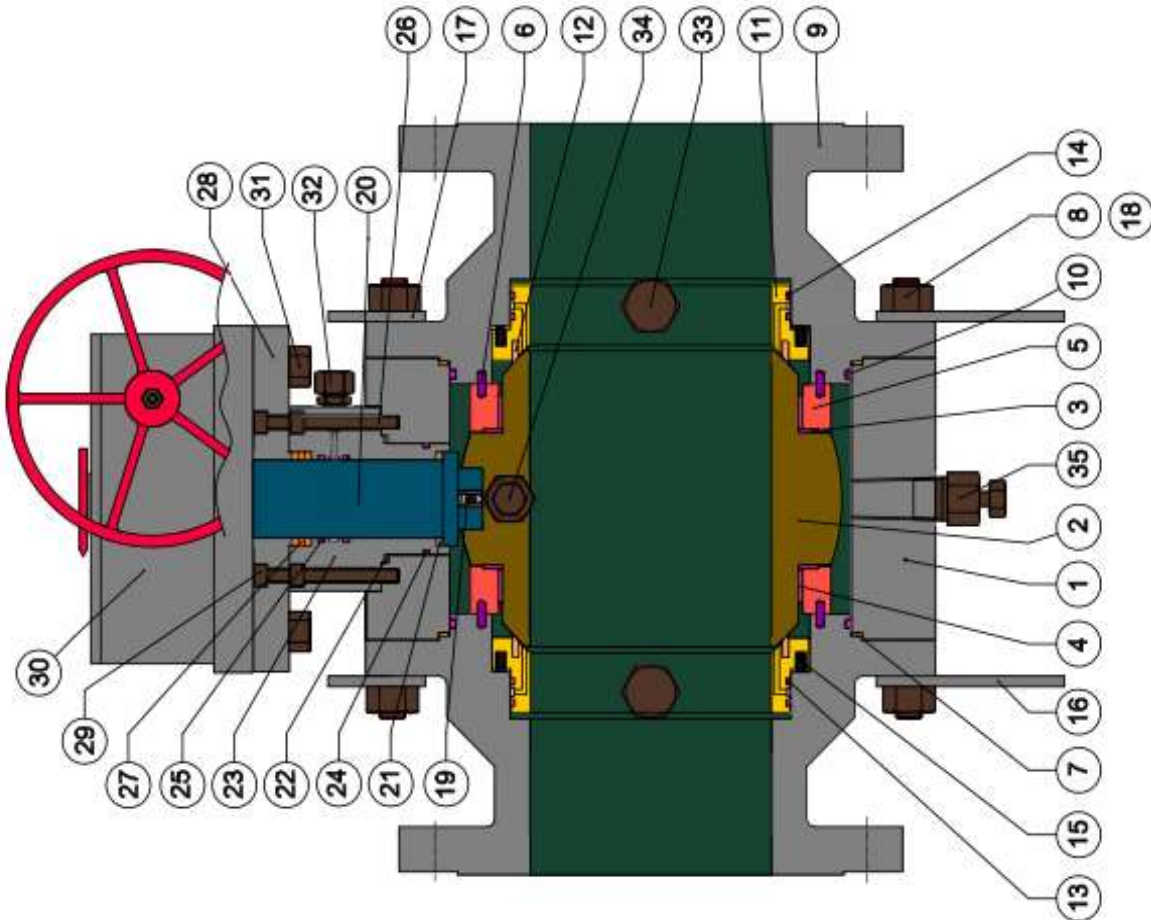
Sr. No	PARTS	Sr. No.	PARTS
1	BODY	15	GASKET (BODY)
2	RETAINER	16	ADAPTER / SIDE CONN.
3	O - RING (RETAINER)	17	STUD
4	SEAT RING	18	NUT
5	SPRING	19	GLAND PACKING
6	STEM	20	GLAND
7	THRUST WASHER (STEM)	21	BOLT (GLAND)
8	O - RING (STEM)	22	BRACKET
9	LOCK PIN	23	BOLT (BRACKET)
10	BALL	24	SEALANT INJECTION (STEM)
11	TRUNNION	25	SEALANT INJECTION (SEAT)
12	BEARING BUSH	26	VENT
13	THRUST WASHER (TRUNNION)	27	DRAIN
14	O-RING (ADAPTER / SIDE CONN.)	28	ANTI - STATIC DEVICE

RECOMMENDED SPARE PARTS FOR MAINTENANCE	
FOR START UP	SEAT RING
3	O - RING (RETAINER)
8	O - RING (STEM)
14	O - RING (ADAPTER / SIDE CONN.)
15	GASKET (BODY)
19	GLAND PACKING

NOTE :- ** 2 PIECE TRUNNION MOUNTED BALL VALVE AVAILABLE IN CASTING & FORGING MATERIAL.



3 PIECE TRUNNION MOUNTED FORGING BALL VALVE



Sr. No.	PARTS	Sr. No.	PARTS
1	BODY	19	ANTI - STATIC DEVICE
2	BALL	20	STEM
3	BEARING BUSH	21	THRUST WASHER (STEM)
4	THRUST WASHER (TRUNNION)	22	GASKET (BONNET)
5	TRUNNION	23	BONNET
6	LOCK PIN	24	O - RING (BONNET)
7	GASKET (BODY)	25	O - RING (STEM)
8	STUD	26	BOLT (BONNET)
9	ADAPTER / SIDE CONN.	27	GLAND PACKING
10	O - RING (ADAPTER)	28	GLAND
11	RETAINER	29	BOLT (GLAND)
12	SEAT RING	30	GEAR OPERATOR
13	O - RING (RETAINER)	31	BOLT (GEAR OPERATOR)
14	FIRE SAFE GASKET / O-RING	32	SEALANT INJECTION (STEM)
15	SPRING	33	SEALANT INJECTION (SEAT)
16	VALVE STAND	34	VENT
17	LIFTING LUG	35	DRAIN
18	NUT		

RECOMMENDED SPARE PARTS	
FOR START UP	FOR MAINTENANCE
---	12 SEAT RING
7 GASKET (BODY)	
10 O - RING (ADAPTER)	
13 O - RING (RETAINER)	
14 FIRE SAFE PACKING / O-RING	
22 GASKET (BONNET)	
24 O - RING (BONNET)	
25 O - RING (STEM)	
27 GLAND PACKING	

NOTE :- ** 3 PIECE & 2 PIECE TRUNNION MOUNTED BALL VALVE AVAILABLE IN CASTING & FORGING MATERIAL.
** INSIDE TRUNNION & OUTSIDE TRUNNION DESIGN ARE AVAILABLE AS PER REQUIREMENT.

Material of Construction for Trunnion Mounted Ball Valve (Model - 4000)

Bill of Material for CAST Trunnion Mounted Ball Valve							
Sr. No.	Part	Carbon Steel	Low Temp. Carbon Steel	Stainless Steel	Duplex	Aluminium Bronze	Nickel Alloys
1	Body	A216 Gr WCB	A325 Gr. LCB, LCC	A351 Gr. CF8M, CF8	A890 Gr. 4A,5A,6A	C95800, C95500, C63200	CW6MC, CW12M, M53-1
2	Retainer	CF8 / CF8M	CF8 / CF8M				
3 & 8	O-Ring	Viton B / AED					
4	Seat Ring	PTFE / RPTFE / Devlon / Peek / Nylon					
5	Spring	Inconel 718 / 750					
6	Stem	F304/F316/17-4PH			F51, F53, F55	Monel	Inconel 625, 750, 825/Monel
7 & 13	Thrust Washer	SS 304/316, Brass	SS 304/316, Brass	SS 304/316, Brass	F51, F53, F55, Brass	Brass	Brass
9	Lock Pin	AISI 410, F304, F316	AISI 410, F304, F316	F 316, F304	F51, F53, F55	Monel	Inconel 625, 750, 825 / Monel
10	Ball	A351 Gr. CF8M, CF8			A890 Gr. 4A,5A,6A	C95800, C95500, C63200, Monel	CW6MC, CW12M, M53-1
11	Trunnion						
12	Bearing Bush	(SS 304/316) + PTFE			Duplex + PTFE	Brass + PTFE	(Inconel/Monel) + PTFE
14	O - Ring	Viton B / AED					
15	Gasket	SPWG + SS (304/316)			SPWG + Duplex	SPWG + Monel	SPWG + (Monel, Inconel)
16	Adaptor	A216 Gr WCB	A325 Gr. LCB, LCC	A351 Gr. CF8M, CF8	A890 Gr. 4A,5A,6A	C95800, C95500, C63200	CW6MC, CW12M, M53-1
17	Stud	A193 Gr. B7 / B7M	A320 Gr. L7 / L7M	A193 Gr B8 / B8M			
18	Nut	A194 Gr. 2H / 2HM	A194 Gr. 4 / 7 / 7M	A194 Gr. 8 / 8MA			
19	Gland packing	Graphoil / PTFE					
20	Gland	AISI 410, F304, F316	F304, F316	F304, F316	F51, F53, F55	Brass / Monel	Inconel/Monel
21	Gland Bolt	A193 Gr. B7 / B7M	A320 Gr. L7 / L7M	A193 Gr B8 / B8M			
22	Bracket	Carbon Steel		Stainless Steel			
21	Bracket Bolt	A193 Gr. B7 / B7M	A320 Gr. L7 / L7M	A193 Gr B8 / B8M			
22	Sealant	Stainless Steel			Duplex	Monel	Inconel / Monel
23	Darin & Vent						
24	Anti-Static				Stainless Steel		

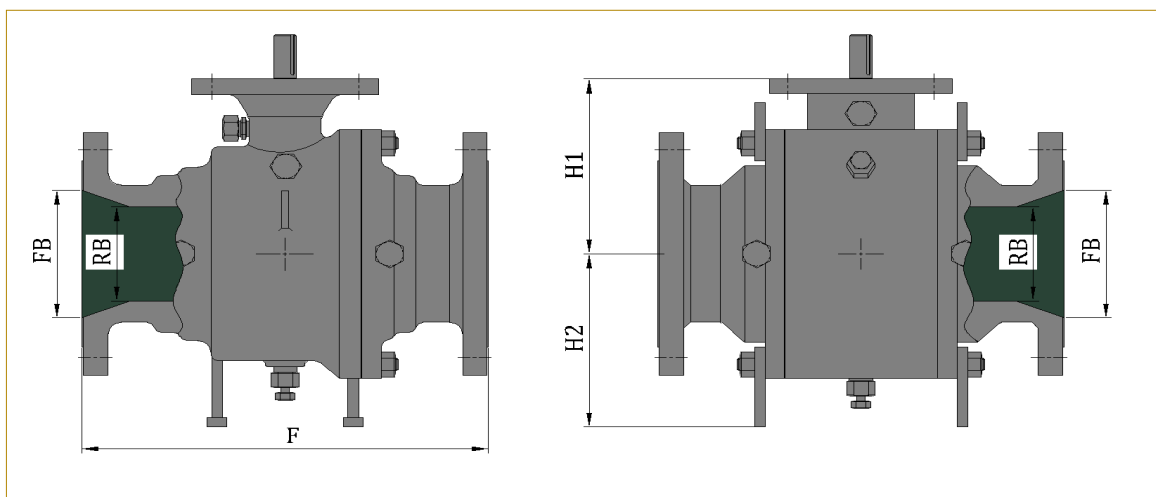
Note:- 'INVACO' reserve right to change Material & Design anytime without prior notice.

Bill of Material for FORGED Trunnion Mounted Ball Valve						
Sr. No.	Part	Carbon Steel	Low Temp. Carbon Steel	Stainless Steel	Duplex	Nickel Alloys
1	Body	A105, A105N	A350 Gr. LF2	A182 Gr. F304, F316	A182 Gr. F51, F53, F55	Inconel 625, 750, 825 / Monel
2	Retainer	F304, F316	F304, F316			
3 & 8	O-Ring	Viton B / AED				
4	Seat Ring	PTFE / RPTFE / Devlon / Peek / Nylon				
5	Spring	Inconel 718 / 750				
6	Stem	F304 / F316 / 17-4PH			F51, F53, F55	Inconel 625, 750, 825 / Monel
7 & 13	Thrust Washer	SS 304 / 316, Brass			F51, F53, F55, Brass	Brass
9	Lock Pin	AISI 410, F304, F316		F 316, F304	F51, F53, F55	Inconel 625, 750, 825 / Monel
10	Ball	A182 Gr. F304, F316				
11	Trunnion					
12	Bearing Bush	(SS 304/316) + PTFE			Duplex + PTFE	(Inconel/Monel) + PTFE
14	O - Ring	Viton B / AED				
15	Gasket	SPWG + SS (304/316)			SPWG + Duplex	SPWG + (Monel, Inconel)
16	Adaptor	A105, A105N	A350 Gr. LF2	A182 Gr. F304, F316	F51, F53, F55	Inconel 625, 750, 825 / Monel
17	Stud	A193 Gr. B7 / B7M	A320 Gr. L7 / L7M	A193 Gr B8 / B8M		
18	Nut	A194 Gr. 2H / 2HM	A194 Gr. 4 / 7 / 7M	A194 Gr. 8 / 8MA		
19	Gland packing	Graphoil / PTFE				
20	Gland	AISI 410, F304, F316	F304, F316	F304, F316	F51, F53, F55	Inconel/Monel
21	Gland Bolt	A193 Gr. B7 / B7M	A320 Gr. L7 / L7M	A193 Gr B8 / B8M		
22	Bracket	Carbon Steel		Stainless Steel		
21	Bracket Bolt	A193 Gr. B7 / B7M	A320 Gr. L7 / L7M	A193 Gr B8 / B8M		
22	Sealant	Stainless Steel			Duplex	Inconel / Monel
23	Darin & Vent					
24	Anti-Static				Stainless Steel	

Note:- "INVACO" reserve right to change Material & Design anytime without prior notice.



Dimensions for Trunnion Mounted Ball Valve (Model - 4000)



ASME CLASS 150 - FULL BORE

Size		FB	F (mm)			H1	H2
in	mm	mm	RF	RTJ	WE	mm	mm
2	50	49	178	191	216	109	113
2.1/2	65	62	191	203	214	135	122
3	80	74	203	216	283	143	128
4	100	100	229	241	305	185	164
6	150	150	394	406	457	246	209
8	200	201	457	470	521	277	236
10	250	252	533	546	559	335	285
12	300	303	610	622	635	372	316
14	350	334	686	699	762	405	348
16	400	385	762	775	838	423	365
18	450	436	864	876	914	447	413
20	500	487	914	927	991	498	447
22	550	538	991	---	1092	536	497
24	600	589	1067	1080	1143	592	536
26	650	633	1143	---	1245	626	603
28	700	684	1245	---	1347	642	665
30	750	735	1295	---	1397	696	705
32	800	779	1372	---	1524	753	756
34	850	830	1473	---	1626	779	791
36	900	874	1524	---	1728	818	822
40	1000	976	1753	---	1956	913	913
42	1050	1020	1790	---	2083	946	945
48	1200	1166	1995	---	2288	1102	1072
56	1400	1360	2489	---	2489	1311	1269

ASME CLASS 150 - REDUCE BORE

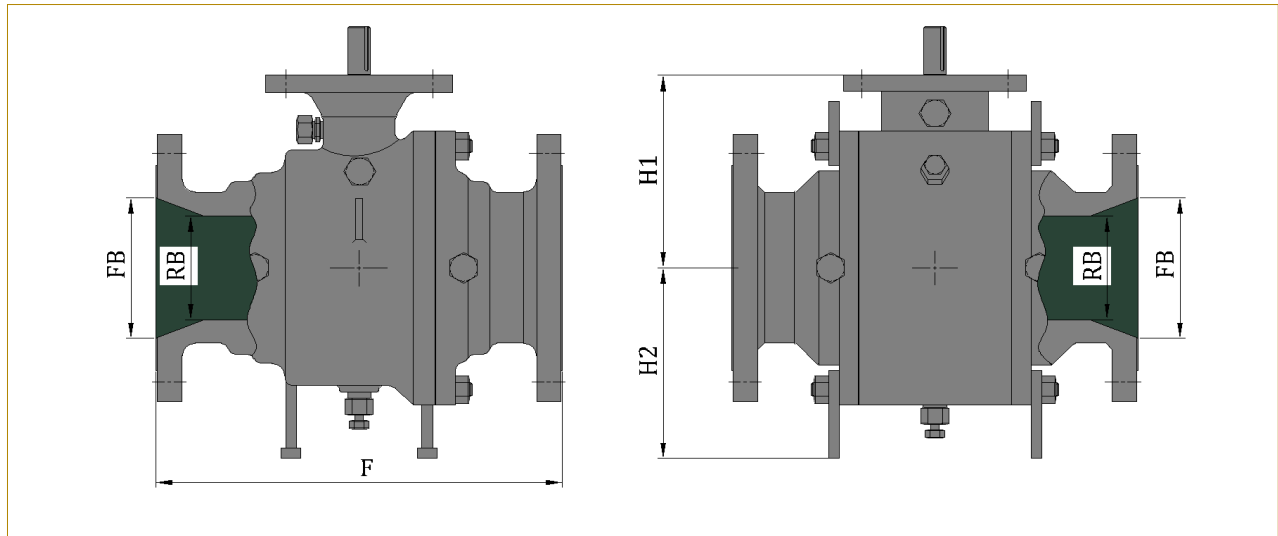
Size		RB	F (mm)			H1	H2
in	mm	mm	RF	RTJ	WE	mm	mm
2 x 1½	50x40	38	178	191	216	100	98
3 x 2	80x50	49	203	216	283	109	113
4 x 3	100x80	74	229	241	305	143	128
6 x 4	150x100	100	394	406	457	185	164
8 x 6	200x150	150	457	470	521	246	209
10 x 8	250x200	201	533	546	559	277	236
12x10	300x250	252	610	622	635	335	285
14x12	350x300	303	686	699	762	372	316
16x14	400x350	334	762	775	838	405	348
18x16	450x400	385	864	876	914	423	365
20x18	500x450	436	914	927	991	447	413
24x20	600x500	487	1067	1080	1143	498	447
30x24	750x600	589	1295	1295	1397	592	536
36x30	900x750	735	1524	---	1728	696	705
42x36	1050x900	874	1855	---	2083	1056	913
48x42	1200x1050	1020	2134	---	2170	1264	1054
56x48	1400x1200	1166	2489	---	2489	1395	1176

Abbr.:-

RF - Raised Faced, RTJ - Ring Type Joint, WE - Butt-weld End
FB - Full Bore, RB - Reduced Bore.

Note:-

** All dimensions are in "mm" unless & otherwise specified.
** "INVACO" reserves the right to change the information anytime without prior notice.



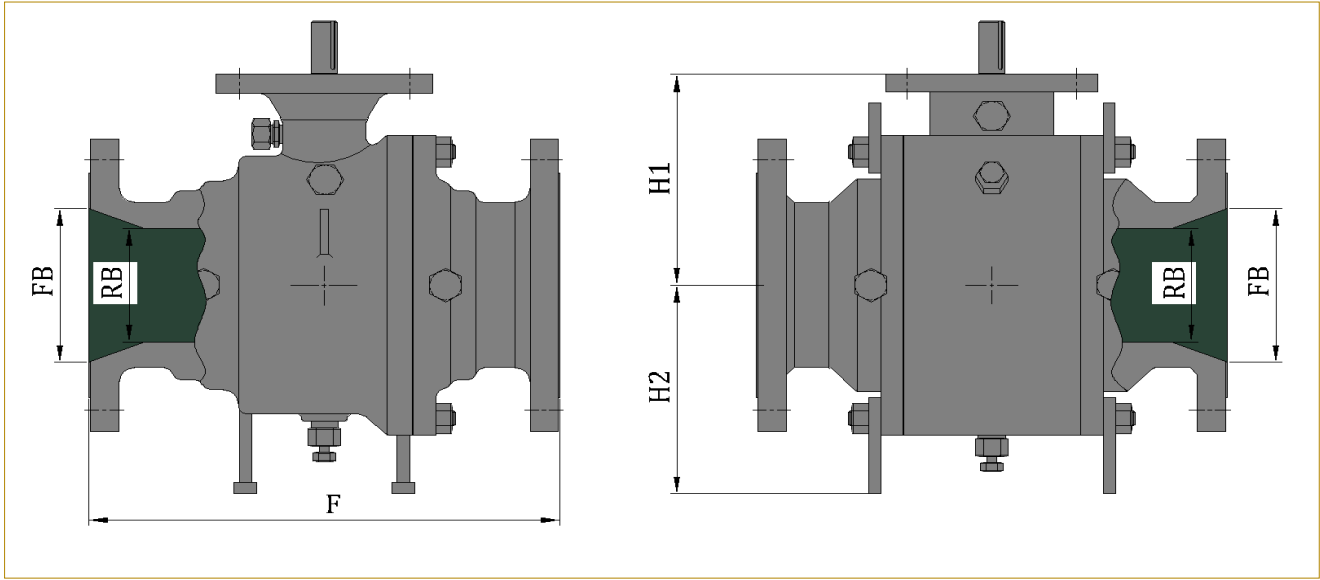
ASME CLASS 300 - FULL BORE

Size		FB	F (mm)			H1	H2
in	mm	mm	RF	RTJ	WE	mm	mm
2	50	49	216	232	216	106	107
2.1/2	65	62	241	257	241	127	122
3	80	74	283	298	283	151	129
4	100	100	305	321	305	198	170
6	150	150	403	419	403	248	209
8	200	201	502	518	521	281	245
10	250	252	568	584	559	333	308
12	300	303	648	664	635	369	341
14	350	334	762	778	762	395	358
16	400	385	838	854	838	436	402
18	450	436	914	930	914	467	476
20	500	487	991	1010	991	506	487
22	550	538	1092	1114	1092	529	504
24	600	589	1143	1165	1143	598	569
26	650	633	1245	1270	1245	638	599
28	700	684	1346	1372	1346	676	683
30	750	735	1397	1422	1397	718	738
32	800	779	1524	1553	1524	753	771
34	850	830	1626	1654	1626	771	805
36	900	874	1727	1756	1727	816	829
40	1000	976	1956	----	1956	913	922
42	1050	1020	2083	----	2083	974	963
48	1200	1166	2170	----	2170	1109	1102
56	1400	1360	2743	----	2743	1292	1272

ASME CLASS 300 - REDUCE BORE

Size		RB	F (mm)			H1	H2
in	mm	mm	RF	RTJ	WE	mm	mm
2 x 1½	50x40	38	216	232	216	100	98
3 x 2	80x50	49	283	298	283	106	107
4 x 3	100x80	74	305	321	305	151	129
6 x 4	150x100	100	403	419	403	198	170
8 x 6	200x150	150	502	518	521	248	209
10 x 8	250x200	201	568	584	559	281	245
12x10	300x250	252	648	664	635	333	308
14x12	350x300	303	762	778	762	369	341
16x14	400x350	334	838	854	838	395	358
18x16	450x400	385	914	930	914	436	402
20x18	500x450	436	991	1010	991	467	476
24x20	600x500	487	1143	1165	1143	506	487
30x24	750x600	589	1397	1422	1397	598	569
36x30	900x750	735	1727	1756	1727	718	738





ASME CLASS 600 – FULL BORE

Size		FB	F (mm)			H1	H2
in	mm	mm	RF	RTJ	WE	mm	mm
2	50	49	292	295	292	105	101
2.1/2	65	62	330	333	330	147	118
3	80	74	356	359	356	181	129
4	100	100	432	435	432	226	169
6	150	150	559	562	559	259	202
8	200	201	660	664	660	308	258
10	250	252	787	791	787	334	305
12	300	303	838	841	838	388	354
14	350	334	889	892	889	401	409
16	400	385	991	994	991	436	447
18	450	436	1092	1095	1092	481	483
20	500	487	1194	1200	1194	509	522
22	550	538	1295	1305	1295	576	571
24	600	589	1397	1407	1397	605	601
26	650	633	1448	1461	1448	641	641
28	700	684	1549	1562	1549	684	690
30	750	735	1651	1664	1651	748	738
32	800	779	1778	1794	1778	763	786
34	850	830	1930	1946	1930	792	810
36	900	874	2083	2099	2083	873	849
40	1000	976	2170	2170	2170	942	942
42	1050	1020	2175	2175	2175	1008	1003
48	1200	1166	2435	2435	2435	1128	1119
56	1400	1360	2710	2710	2710	1287	1207

ASME CLASS 600 – REDUCE BORE

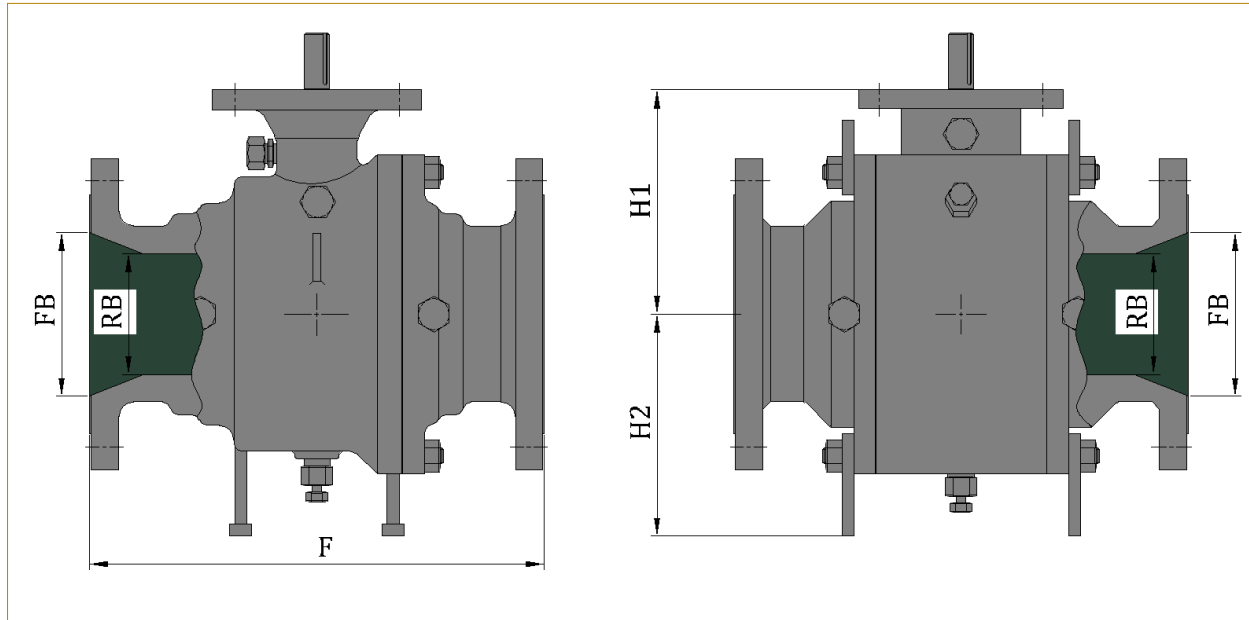
Size		RB	F (mm)			H1	H2
in	mm	mm	RF	RTJ	WE	mm	mm
2 x 1½	50x40	38	292	295	292	102	98
3 x 2	80x50	49	356	359	356	105	101
4 x 3	100x80	74	432	435	432	181	129
6 x 4	150x100	100	559	562	559	226	169
8 x 6	200x150	150	660	664	660	259	202
10 x 8	250x200	201	787	791	787	308	258
12x10	300x250	252	838	841	838	334	305
14x12	350x300	303	889	892	889	388	354
16x14	400x350	334	991	994	991	401	409
18x16	450x400	385	1092	1095	1092	436	447
20x18	500x450	436	1194	1200	1194	481	483
24x20	600x500	487	1397	1407	1397	509	522
30x24	750x600	589	1651	1664	1651	605	601
36x30	900x750	735	2083	2099	2083	748	738

Abbr.: -

RF – Raised Faced, RTJ – Ring Type Joint, WE – Butt-Weld End,
FB – Full Bore, RB – Reduced Bore.

Note:-

**All dimensions are in “mm” unless & otherwise specified.
**“INVACO” reserve the right to change the information anytime without prior notice.



ASME CLASS 900 - FULL BORE

Size		FB	F (mm)			H1	H2
in	mm	mm	RF	RTJ	WE	mm	mm
2	50	49	368	371	368	105	104
2.1/2	65	62	419	422	419	146	121
3	80	74	381	384	381	171	133
4	100	100	457	460	457	217	167
6	150	150	610	613	610	266	211
8	200	201	737	740	737	296	262
10	250	252	838	841	838	369	328
12	300	303	965	968	965	397	375
14	350	322	1029	1038	1029	407	389
16	400	373	1130	1140	1130	447	458
18	450	423	1219	1232	1219	498	514
20	500	471	1321	1334	1321	549	547
22	550						
24	600	570	1549	1568	1549	634	644
26	650	617	1651	1674	1651	668	683
28	700	665	1753	1775	1753	683	728
30	750	712	1880	1902	1880	746	784
32	800	760	2032	2054	2032	797	819
34	850	808	2159	2188	2159	813	863
36	900	855	2286	2315	2286	857	913

ASME CLASS 900 - REDUCE BORE

Size		RB	F (mm)			H1	H2
in	mm	mm	RF	RTJ	WE	mm	mm
2 x 1½	50x40	38	368	371	368	100	102
3 x 2	80x50	49	381	384	381	105	104
4 x 3	100x80	74	457	460	457	171	133
6 x 4	150x100	100	610	613	610	217	167
8 x 6	200x150	150	737	740	737	266	211
10 x 8	250x200	201	838	841	838	296	262
12x10	300x250	252	965	968	965	369	328
14x12	350x300	303	1029	1038	1029	397	375
16x14	400x350	322	1130	1140	1130	407	389
18x16	450x400	373	1219	1232	1219	447	458
20x18	500x450	423	1321	1334	1321	498	514
24x20	600x500	471	1549	1568	1549	549	547
30x24	750x600	570	1880	1902	1880	634	644
36x30	900x750	712	2286	2315	2286	746	784

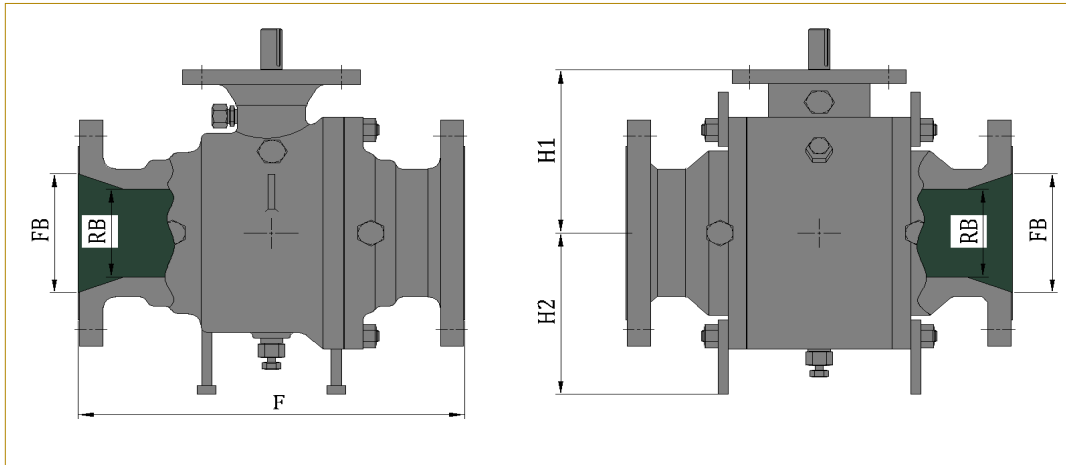
Abbr.:-

RF - Raised Faced, RTJ - Ring Type Joint, WE - Butt- Weld End,
FB - Full Bore, RB - Reduced Bore.

Note:-

**All dimensions are in "mm" unless & otherwise specified.
** "INVACO" reserve the right to change the information anytime without prior notice.





ASME CLASS 1500 - FULL BORE

Size		FB	F (mm)			H1	H2
in	mm	mm	RF	RTJ	WE	mm	mm
2	50	49	368	371	368	106	105
2.1/2	65	62	419	422	419	144	126
3	80	74	470	473	470	176	134
4	100	100	546	549	546	223	169
6	150	144	705	711	705	271	237
8	200	192	832	841	832	334	298
10	250	239	991	1000	991	389	356
12	300	287	1130	1146	1130	421	429
14	350	315	1257	1276	1257	458	487
16	400	360	1384	1407	1384	486	547
18	450	405	1537	1559	1537	587	619
20	500	455	1664	1686	1664	649	687
24	600	530	2043	2071	2043	711	754

ASME CLASS 1500 - REDUCE BORE

Size		RB	F (mm)			H1	H2
in	mm	mm	RF	RTJ	WE	mm	mm
2 x 1½	50x40	38	368	371	368	100	102
3 x 2	80x50	49	470	473	470	106	105
4 x 3	100x80	74	546	549	546	176	134
6 x 4	150x100	100	705	711	705	223	169
8 x 6	200x150	144	832	841	832	271	237
10 x 8	250x200	192	991	1000	991	334	298
12x10	300x250	239	1130	1146	1130	389	356
14x12	350x300	287	1257	1276	1257	421	429
16x14	400x350	315	1384	1407	1384	458	487
18x16	450x400	360	1537	1559	1537	486	547
20x18	500x450	405	1664	1686	1664	587	619
24x20	600x500	455	2043	2071	2043	649	687

ASME CLASS 2500 - FULL BORE

Size		FB	F (mm)			H1	H2
in	mm	mm	RF	RTJ	WE	mm	mm
2	50	42	451	454	451	136	139
2.1/2	65	52	508	540	508	158	172
3	80	62	578	584	578	187	202
4	100	87	673	683	673	238	239
6	150	131	914	927	914	287	276
8	200	179	1022	1038	1022	399	357
10	250	223	1270	1292	1270	481	446
12	300	265	1422	1445	1422	568	510

ASME CLASS 2500 - REDUCE BORE

Size		RB	F (mm)			H1	H2
in	mm	mm	RF	RTJ	WE	mm	mm
2 x 1½	50x40	38	451	454	451	127	124
3 x 2	80x50	42	578	584	578	136	139
4 x 3	100x80	62	673	683	673	187	202
6 x 4	150x100	87	914	927	914	238	239
8 x 6	200x150	131	1022	1038	1022	287	276
10 x 8	250x200	179	1270	1292	1270	399	357
12x10	300x250	223	1422	1445	1422	481	446

Abbr.: - RF – Raised Faced, RTJ – Ring Type Joint, WE – Butt-Weld End, FB – Full Bore, RB – Reduced Bore.

Note: - **All dimensions are in "mm" unless & otherwise specified. For larger size kindly consult "INVACO".
**"INVACO" reserve the right to change the information anytime without prior notice.

Torque for Trunnion Mounted Ball Valve (Model - 4000)

Torque for Trunnion Mounted Ball Valve in N-m							
Size		ASME CLASS					
in	mm	150	300	600	900	1500	2500
2	50	65	82	124	263	285	514
2.1/2	65	92	144	251	413	623	1053
3	80	113	160	277	453	674	1172
4	100	174	302	545	717	1061	1670
6	150	480	706	1196	1747	2711	4463
8	200	835	1330	2042	3233	5415	7723
10	250	1157	1939	3008	4495	7452	11795
12	300	1554	2529	3794	6083	9754	13292
14	350	2283	3566	5614	8696	14520	----
16	400	3065	4577	7519	12723	19669	----
18	450	4357	7001	9627	16895	28243	----
20	500	5585	9450	15114	23239	37729	----
24	600	9867	15667	24243	37268	59138	----
26	650	10842	16795	39582	59952	----	----
28	700	12521	18573	43861	66132	----	----
30	750	14163	21142	48061	70825	----	----
32	800	16092	24661	51856	76672	----	----
34	850	18132	35503	55451	82213	----	----
36	900	29435	38542	59796	88649	----	----
40	1000	34236	44105	67722	----	----	----
42	1050	38524	47717	73683	----	----	----
48	1200	41536	80852	133806	----	----	----
54	1350	61597	102644	162386	----	----	----
56	1400	101198	122120	191385	----	----	----
60	1500	123342	152655	243406	----	----	----

- Note:** -
- 1 For Peek or Devlon add 1.2 & for metal seat add 1.6.
 - 2 For actuator selection or sizing, factor of safety 1.3 – 1.5 is recommended.
 - 3 INVACO reserve the right to change Design, Material or specification or any other information without prior notice.



Coefficient of Flow for Trunnion Mounted Ball Valve (Model - 4000)

Coefficient of Flow (Cv) for Trunnion Mounted Ball Valve in gpm.							
Size		ASME CLASS					
in	mm	150	300	600	900	1500	2500
2	50	466	466	466	466	466	343
2.1/2	65	764	764	764	746	746	525
3	80	1092	1092	1092	1092	1092	767
4	100	2052	2052	2052	2052	2052	1553
6	150	4916	4916	4916	4916	4530	3749
8	200	9136	9136	9136	9136	8337	7246
10	250	14361	14361	14361	14361	12917	11246
12	300	21546	21546	21546	21540	19331	16480
14	350	26180	26180	26180	24332	23286	----
16	400	34785	34785	34785	32650	30414	----
18	450	46433	46433	46433	43705	----	----
20	500	57931	57931	57931	54187	----	----
24	600	84739	84739	84739	79360	----	----
26	650	102224	102224	102224	97122	----	----
28	700	119360	119360	119360	112821	----	----
30	750	137823	137823	137823	129332	----	----
32	800	154818	154818	154818	147358	----	----
34	850	175753	175753	175753	166560	----	----
36	900	194881	194881	194881	186500	----	----
40	1000	243023	----	----	----	----	----
42	1050	265428	----	----	----	----	----
48	1200	363781	----	----	----	----	----
54	1350	460586	----	----	----	----	----
56	1400	494904	----	----	----	----	----
60	1500	568798	----	----	----	----	----

- Note:**
- 1 All size are Full Bore as per API 6D.
 - 2 The Coefficient of Flow (Cv) is defined in U.S. gallon per minute (gpm) of water required to pass through a valve with a pressure drop of 1 psi.
 - 3 INVACO reserve the right to change Design, Material or specification or any other information without prior notice.



Body & Trim Material for Trunnion Mounted Ball Valve (Model – 4000):

Body & Trim Material:-		
Material Group / Type	Casting	Forging
Carbon Steel	A216 Gr WCB , WCA	A105 / A 106
	A216 Gr WCC	A105N
Low Temperature Carbon Steel	A352 Gr LCB	A350 Gr LF2 CL.1
	A352 Gr LCC	
	A352 Gr LC1 / LC2	
	A352 Gr LC3	A350 Gr LF3 CL.1
Alloy Steel	A217 Gr WC1	A182 Gr F1
	A217 Gr WC5	
	A217 Gr WC6	A182 Gr F11 CL.2
	A217 Gr WC9	A182 Gr F22 CL.3
	A217 Gr C5	A182 Gr F5a
	A217 Gr C12	A182 Gr F9
	A217 Gr C12A	A182 Gr F91
Stainless Steel	A217 Gr CA15	A182 Gr F6A / ANSI 410
	A351 Gr CF10M	A182 Gr F304H
	A351 Gr CF8A	A182 Gr F347H
	A351 Gr CF8	A182 Gr F304
	A351 Gr CF3	A182 Gr F304L
	A351 Gr CF8M	A182 Gr F316
	A351 Gr CF3M	A182 Gr F316L
	A351 Gr CF8C	A182 Gr F347
Duplex / Super Duplex	A890 Gr CD4MCuN (1B)	
	A890 Gr CD3MCuN (1C)	
	A890 Gr CE8MN (2A)	
	A890 Gr CD3MN (4A)	A182 Gr F51
	A890 Gr CE3MN (5A)	A182 Gr F53
	A890 Gr CD3MWCuN (6A)	A182 Gr F55
Nickel / Super Nickel Alloys	A494 Gr CY40	Inconel 600
	A494 Gr CZ100	
	A494 Gr CW6MC	Inconel 625
	A494 Gr M 35 -1	Monel 400
		Monel K-500
	A494 Gr CW6M / CW12MW	Hastalloy C / C-276
Aluminum Bronze	B148 Gr C95200	
	B148 Gr C95400	
	B148 Gr C95500	
	B148 Gr C95800	
Titanium	B367 Gr C2	B381 Gr F2
	B367 Gr C3	B381 Gr F3
Special Materials	A351 Gr CN7M	Alloy 20
	A351 Gr CN2MCuN	904L
	A351 Gr CK3MCuN	SMO 254 / A182 Gr F44
	CB7CU -1	17 – 4 PH

Note: - Wrought names are given as a reference for commonly accepted equivalent material. "INVACO" cannot hold any liability for any damages incurred due to this table. For more information kindly contact "INVACO".

Material Specification for Fastener's:-

Bolting Material	Nut Materials	Temperature Range	Body Material
ASTM A193 Gr. B7	ASTM A194 Gr. 2H	-40°C to +538°C	Carbon Steel
ASTM A193 Gr B7M	ASTM A194 Gr. 2HM	-50°C to +538°C	Low Alloy Steel
ASTM A320 Gr. L7	ASTM A194 Gr. 7/4	-100°C to +371°C	Low Temp. Carbon Steel
ASTM A320 Gr. L7M	ASTM A194 Gr. 7M	-75°C to +538°C	Low Temp. Carbon Steel
ASTM A193 Gr. B8	ASTM A194 Gr. 8	-200°C to +538°C	Stainless Steel
ASTM A193 Gr. B8M	ASTM A194 Gr. 8M / 8MA	-200°C to +538°C	Stainless Steel/Nickel Alloys / AL-Br / Duplex
A453 Gr 660 CL A	A453 Gr 660 CL A	-30°C to +538°C	Duplex

NOTE:-

- Above temperature range is for BOLTING, not body materials.
- Welding repair on Bolting is strictly not allowed.
- Temperature range & use may vary with requirement like NACE, Impact Test.
- For more information refer ASME B31.3, B16.34, A193, A194, A320 & A453.
- Other Bolt & Nut material available on request.
- INVACO cannot hold any liability for any damages incurred to this table.

Coating for Fastener's

- ENP
- Hot Deep Galvanized
- Hot Zinc
- Red Xylem
- PTFE Coating
- Cadmium
- Cadmium with PTFE

Seat Insert & Seal Material:-

Materials	Temperature Range °C		Pressure Class		Size	
	Min.	Max.	Seat Rings	Seal	Seat Rings	Seal
PTFE (Glass Filled)	- 100	+200	600#	----	24"(600mm)	----
PTFE (Carbon Filled)	- 100	+180	600#	----	24"(600mm)	----
Nylon6 (Devlon)	- 60	+140	2500#	----	60"(1500mm)	----
Nylon	- 60	+120	2500#	----	60"(1500mm)	----
Peek	- 100	+240	2500#	----	24"(600mm)	----
Derlin	- 45	+90	1500#	----	24"(600mm)	----
Viton B	- 29	+180	600#	2500#	60"(1500mm)	60"(1500mm)
Viton AED	- 40	+200	600#	2500#	60"(1500mm)	60"(1500mm)
Buna N / NBR	- 30	+120	600#	2500#	60"(1500mm)	60"(1500mm)
HNBR	- 40	+150	600#	2500#	60"(1500mm)	60"(1500mm)
Graphite	- 240	+560	----	2500#	24"(600mm)	60"(1500mm)

NOTE: - **Above table is for reference, information may differ, INVACO cannot hold any liability for any damages incurred due to this table.

** Temperature & Pressure range may vary with different brands manufacturer.

Static and Dynamic Seals (Gaskets & Packing):-

- Graphite Packing / Gasket.
- PTFE, R-PTFE Packing / Rings.
- Spiral Wound Gasket (Soft + Metal filled)
- Metal Gasket (RTJ), BX, T type seal ring).
- Lip Seal (U/O type, radial or face seal).



Testing Pressure:-

ASME CLASS	Working Pressure			Body Test (Hydro)			Seat Test (Hydro)			Seat Test (Air)		
	psi	bar	Kg/cm ²	psi	bar	Kg/cm ²	psi	bar	Kg/cm ²	psi	bar	Kg/cm ²
150	285	19.6	20	464	32	33	333	23	23.5	100	6	7
300	741	51.1	52	1145	79	81	842	58	59	100	6	7
400	988	68.1	69	1523	105	107	1189	82	84	100	6	7
600	1480	102.1	104	2262	156	159	1653	114	116	100	6	7
800	2001	138	141	3046	210	214	2248	155	158	100	6	7
900	2222	153.2	156	3423	236	240	2494	172	175	100	6	7
1500	3703	255.3	260	5685	392	400	4177	288	293	100	6	7
2500	6171	425.5	434	945	652	665	6932	478	487	100	6	7

Note: - Rating Pressure may be change for different materials.

Spares part list:-

For 2 Piece Design			
Part No	Part	Quantity for Start up	Quantity for 2 years Operation
4	Seat Ring (Seat Insert)	---	3 nos
3	O-Ring (Retainer Ring)	2	3 nos
8	O- Ring (Stem)	2	3 nos
14	O – Ring (Adaptor)	2	3 nos
15	Gasket (Body)	2	3 nos
19	Gland Packing	1 Set	3 Set

For 3 Piece Design			
Part No	Part	Quantity for Start up	Quantity for 2 years Operation
7	Gasket (Body)	---	3 nos
10	O – Ring (Adaptor)	2	3 nos
12	Seat Ring (Seat Insert)	2	3 nos
13	O – Ring (Retainer)	2	3 nos
14	O – Ring & Fire Safe Gasket	2	3 nos
22	Gasket (Bonnet)	2	3 nos
24	O – Ring (Bonnet)	2	3 nos
25	O –Ring (Stem)	2	3 nos
27	Gland Packing	1 Set	3 Set



How to Order Trunnion Mounted Ball Valve (Model – 4000):

Valve Type	Size	Pressure Rating	End. Conn.	Body Material	Ball Material	Stem	Seat Ring	Seal Ring	Operation	Special
A	B	C	D	E	F	G	H	I	J	K

A- Valve Type

Code	Valve Type	Series	Code	Valve Type	Series
01	2 PCs Trunnion Mounted Full Bore	TF - 4000	08	3 PCs Floating Reduced Bore Socket Weld	SWR - 4900
02	2 PCs Trunnion Mounted Reduced Bore	TR - 4000	09	3 PCs Floating Full Bore Screwed (F - NPT)	SCF - 4900
03	3 PCs Trunnion Mounted Full Bore	THF - 4000	10	3 PCs Floating Reduced Bore Screwed (F-NPT)	SCR - 4900
04	3 PCs Trunnion Mounted Reduced Bore	THR - 4000	11	3 PCs Floating Full Bore But Weld	BWF - 4900
05	2 PCs Floating Full Bore	F - 4500	12	3 PCs Floating Reduced Bore But Weld	BWR - 4900
06	2 PCs Floating Reduced Bore	R - 4500	13	1 PCs Floating Full Bore	F - 4800
07	3 PCs Floating Full Bore Socket Weld	SWF - 4900	14	1 PCs Floating Reduced Bore	R - 4800

B - Size

NPS	½"	¾"	1"	1.1/2"	2"	2.1/2"	3"	4"	5"	6"	8"	10"	12"
DN	15	20	25	40	50	65	80	100	125	150	200	250	300
Code	1A	2A	01	3A	02	4A	03	04	05	06	08	10	12
NPS	14"	16"	18"	20"	22"	24"	26"	28"	30"	32"	34"	36"	40"
DN	350	400	450	500	550	600	650	700	750	800	850	900	1000
Code	14	16	18	20	22	24	26	28	30	32	34	36	40

Note:- For higher size code use respective NPS (inch) as Code

C - Rating

Class	125	150	300	400	600	800	900	1500	2500	PN 2.5	PN6	PN10	PN16
Code	01	02	03	04	05	06	07	08	09	10	11	12	13
Class	PN 25	PN 40	PN 63	PN 100	PN 160	PN 320	1000 PSI	2000 psi	3000 psi	5000 psi	1000 0psi	15000 psi	20000 psi
Code	14	15	16	17	18	19	20	21	22	23	24	25	26

D - End Connection

Class	Type	Class	Type	Class	Type	Class	Type
A	Raised Face (RF)	D	But Weld	G	Hub	J	But Weld x RTJ
B	Flat Face (FF)	E	Socket Weld	H	Socket X Screw	K	Wafer
C	Ring Type Joint (RTJ)	F	Screwed	I	But Weld x RF	L	Other



E - Body / Adaptor Material

Code	Material	Code	Material	Code	Material	Code	Material	Code	Material
01	WCB	10	CF3M	19	C95500	28	F304L	37	Incoloy825
02	WCC	11	CK3MCuN	20	C95800	29	F316L	38	Incoloy925
03	LCB	12	CN7M	21	C62300	30	17 - 4PH	39	Monel K400
04	LCC	13	4A	22	A105	31	F11	40	Monel K500
05	WC6	14	5A	23	A105N	32	F51	41	Inconel 600
06	CA15	15	6A	24	LF2	33	F53	42	Inconel 625
07	CF8	16	M35-1	25	F6a	34	F55	43	Hastalloy C276
08	CF8M	17	CW6MC	26	F304	35	F44	44	904L
09	CF3	18	CW12MW	27	F316	36	Incoloy800	45	Other

F - Ball Material

Code	Material	Code	Material	Code	Material	Code	Material
01	CF8	10	M35-1	19	304L	28	Incoloy825
02	CF8M	11	CW6MC	20	316L	29	Incoloy925
03	CF3	12	CW12MW	21	17-4PH	30	Monel K400
04	CF3M	13	C95500	22	F11	31	Monel K500
05	CK3MCuN	14	C95800	23	F51	32	Inconel 600
06	CN7M	15	C62300	24	F53	33	Inconel 625
07	4A	16	A105(ENP)	25	F55	34	Hastalloy C276
08	5A	17	304	26	F44	35	904L
09	6A	18	316	27	Incoloy800	36	Other

G - Stem Material

Code	Material	Code	Material
A	A105N	I	F53
B	410	J	F55
C	F6A	K	F44
D	F304/F304L	L	Incoloy 825
E	F316/F316L	M	Inconel 625
F	17-4PH	N	Monel
G	F11	O	904L
H	F51	P	Other

H - Seat Ring

Code	Material
A	PTFE
B	RPTFE
C	DEVLON
D	PEEK
E	NYLON
F	DERLIN
G	EPDM
H	Other

I - Seal Ring

Code	Material
A	EPDM
B	VITON - B
C	VITON-AED
D	NBR / BUNA N
E	HNBR
F	Other

Example: - 8" x 150#, 3Pc Trunnion Mounted Full Bore, Flanged RF, Body/Adaptor - CF8M, Ball & Stem - F316, Seat Ring - RPTFE, Seal Ring - Viton AED, Gear Operated, Cryogenic Design.

CODE: - 03 08 02 A 08 20 E B C C C

J - Operations

Code	Operations	Code	Special Req.
A	Bare Stem	A	Extended Bonnet
B	Lever	B	Extended Stem
C	Gear	C	Cryogenic
D	Electrical Act'r	D	Other
E	Pneumatic Act'r	E	

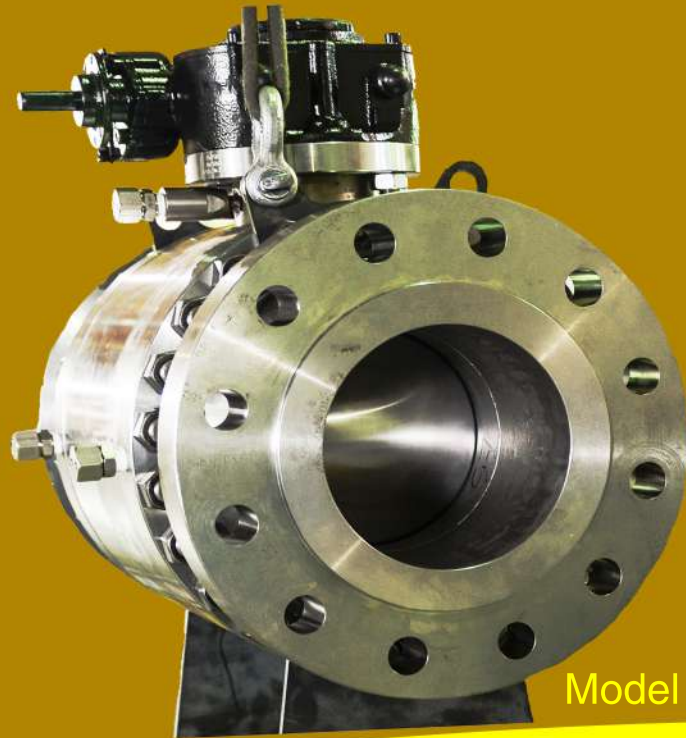
K - Special



INVACO PVT LTD
INDUSTRIAL VALVE COMPANY



Trunnion Mounted Ball Valve



Model - 4000

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Your Local INVACO Representative -

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